



Alaska's Spring River Ice Breakup and Climate Services

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Outline...

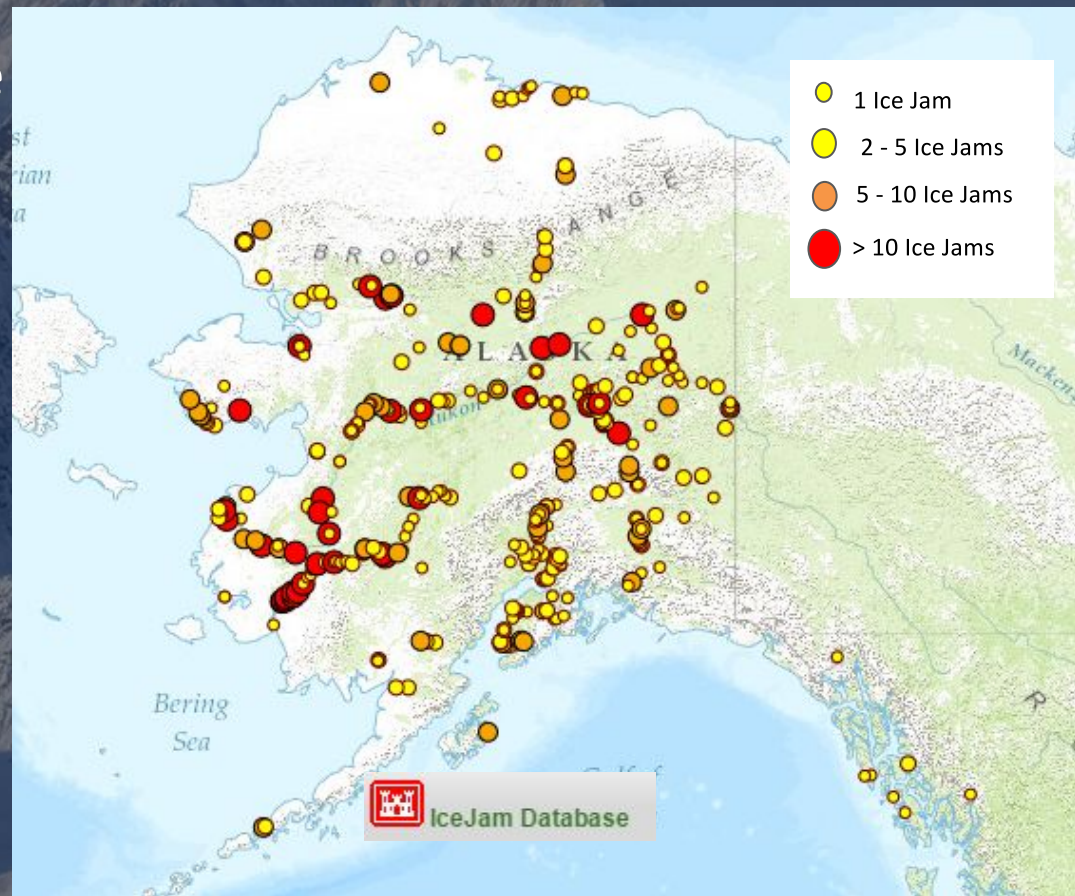
- Let's begin with a little background on ice Jams in Alaska
- Starts in early April with briefings from the Climate Services Manager
- Breakup Outlook issued – incorporates climate predictions
- Take the message on the road
- Launch River Watch – great example of IDSS that has been going on since the 1970s
- What are the outcomes and impacts from this work?



Ice Jams

Typical ice jam locations include:

- Strong Intact ice cover
- Sharp bends
- Decreases in channel slope
- Constrictions (i.e. bridges)
- Bars and Islands





The ingredients for a ice jam...

- Ice thickness and areal extent, aufeis and jumbled ice formation
- Snowpack
- **Spring weather pattern**
 - April and early May temps control
 - Snowmelt rates
 - Thermal condition and integrity of ice
 - Type of breakup (Mechanical vs. Thermal)



Types of Breakups

Most Breakups are a Blend

- **Dynamic breakup**

- Ice remains hard and resistant to breaking up
- Ice moves when pushed by ice and water from upstream
- Ice jams form that can cause upstream flooding
- Cool spring, later breakup, higher threat of serious flooding
- Extreme cases are Yukon River in May 2009 and 2013.

- **Thermal breakup**

- Ice becomes very rotten (candled) before ice from upstream arrives
- Rotten ice is weak and has less resistance to breaking into very small pieces
- No significant ice jams form
- Warm spring, earlier breakup, lower threat of serious flooding.
- Extreme case would occur with very little snow melt inflow and warm sunny weather to rot the ice



Build the breakup outlook...

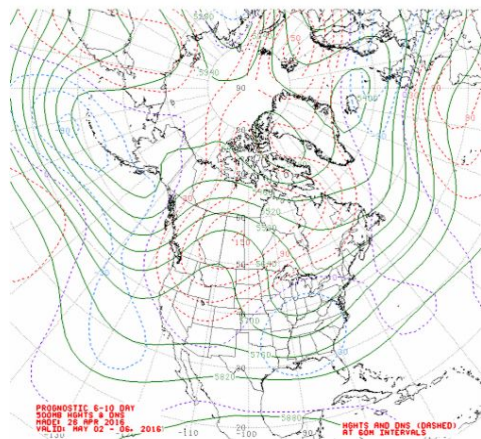
Climate at your finger tips

Week and 2 week outlooks

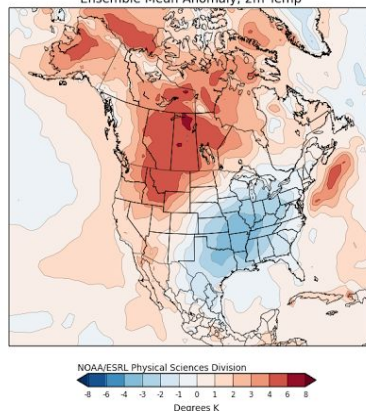
Week 1-2 Outlook Valid May 02-08, 2016

posted Apr 26, 2016, 3:17 PM by Richard Thoman - NOAA Federal

The first week in May looks to bring somewhat unsettled weather (for the season) for much of Alaska, with near to below normal heights over most of the state even as the long wave trough remains anchored just east of the dateline, as seen in the April 26th CPC manual 500mb heights and anomalies (below left). This pattern will allow for some moisture advection into the state (especially central and southern Southeast), and as snow and ice melt and green-up progress north and westward over mainland Alaska, local moisture sources become available as well. With the climatological snow melt progressing, inland areas that a typically snow-free in early May will be less likely to be significantly warmer than normal, while near the coast the strong positive PDO pattern continues, with warmer than average SSTs near shore Alaska and all of the western North American coast. Additionally, Bering Sea ice coverage is decreasing rapidly and by the week 1-2 period decreasing ice coverage is likely to be evident in the southernmost Chukchi Sea. Overall this is still a mild, though not excessively warm pattern for Alaska, as seen in the ESRL 00Z Apr 26 GFS reforecast mean 2m temperature anomalies for May 02-06 (below right). Guidance suggests that late in the week 1-2 period ridging may rebuild across westernmost North America, poking as far northwest as eastern Interior Alaska and give a boost to temperatures.



6-10 day (150-264 hr) fcst from 00Z Tue Apr 26.
Valid 06Z Mon May 02 - 00Z Sat May 07
Calculated with 1985-2010 Reforecast2 data.
Ensemble Mean Anomaly, 2m Temp



MJO activity has been largely incoherent since mid-month, with recent deep tropical convection largely confined to the southern hemisphere, as seen in the OLR anomaly plot below. Recently the convection near the dateline just north of the equator has flared. However, as we move into the warm season, the direct connection to the tropics weaken and the more regional scale features start to dominate, which can lead to increased confidence (when related to SSTs or sea

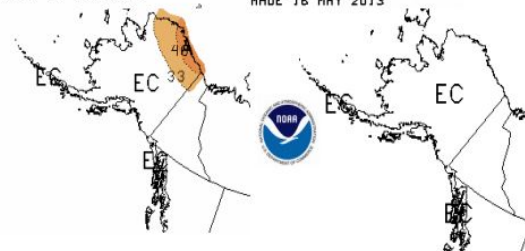
Month and 3 month discussion

Climate Product Discussion
Alaska Region, May 21, 2013

Climate Prediction Center Official Forecasts and Reasoning, June Forecast

ONE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID JUN 2013
MADE 16 MAY 2013

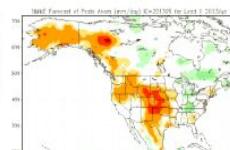
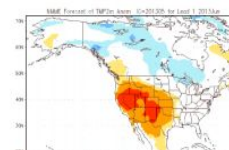
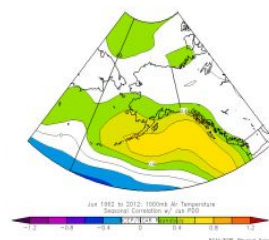
ONE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
0.5 MONTH LEAD
VALID JUN 2013
MADE 16 MAY 2013



Above-normal temperatures are favored over northern Alaska, based primarily on the traditional statistical tools (SMLR, CCA, and OCN) which tend to emphasize longer-term trends. Elsewhere across Alaska, equal chances (EC) of below, near, and above-normal temperatures is predicted.

Regional Discussion for June

A weak negative PDO style sea surface temperature anomalies continue across the North Pacific, with moderate correlation (below left) with near surface temperatures along the Gulf Coast, Alaska Peninsula and eastern Aleutians. As usual, there is no useful correlation with precipitation (bottom left). Station-based Optimum Climate Normals (OCN), unlike later in the summer, show little trend in June. The dynamic models have little coherence, though through May 21st the CFSv2 has been very consistent in forecasting warm and dry in most of Alaska except Southeast and western coastal, where forecasts have been more variable. The Multi-Model ensembles shows little coherence for temperature (below center) but broad support for below median precipitation (below right).

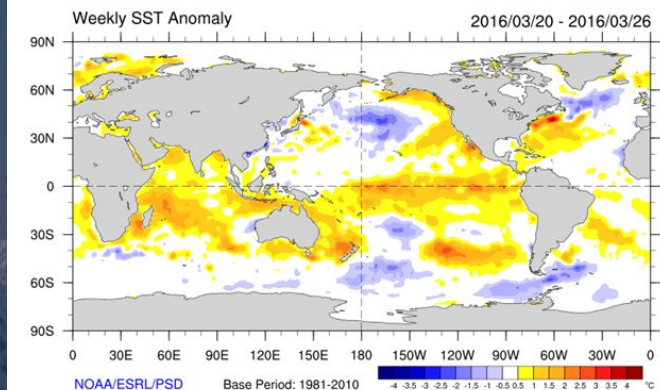




Current and 1-2 weeks out

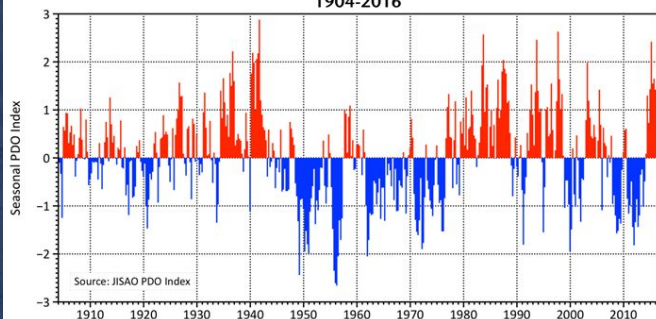
Custom products...briefings upon request

Global SSTs

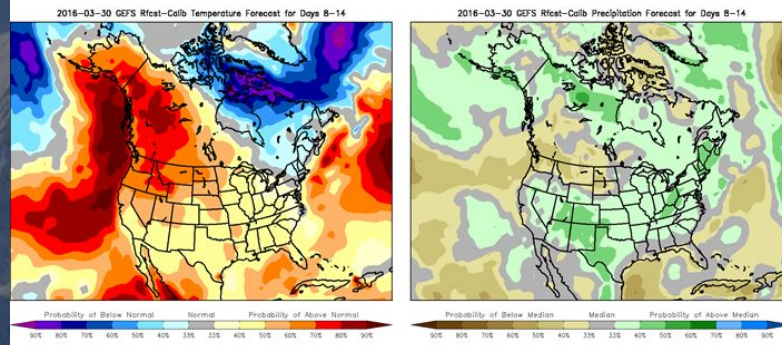


PDO: The long view

Pacific Decadal Oscillation Index
3-Month Non-Overlapping Seasons
1904-2016



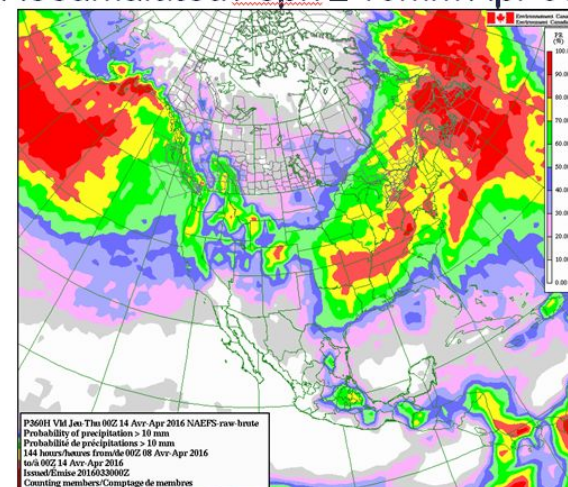
GEFS Reforecast: Week 2



El Niño is on the way out

Tropical Pacific convection will have decreasing impact later in the warm season

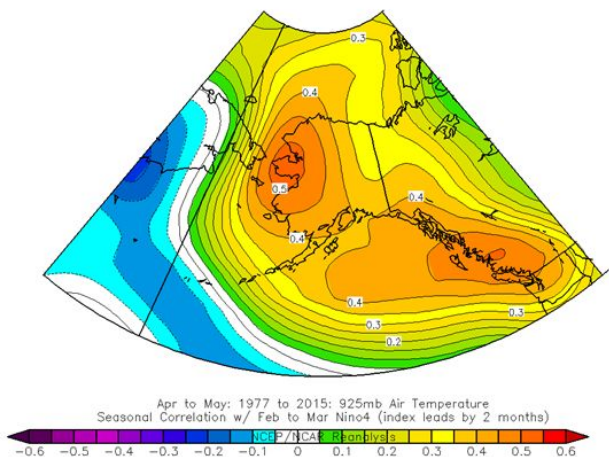
NAEFS Probabilities Accumulated Pcpn ≥ 10 mm Apr 08-



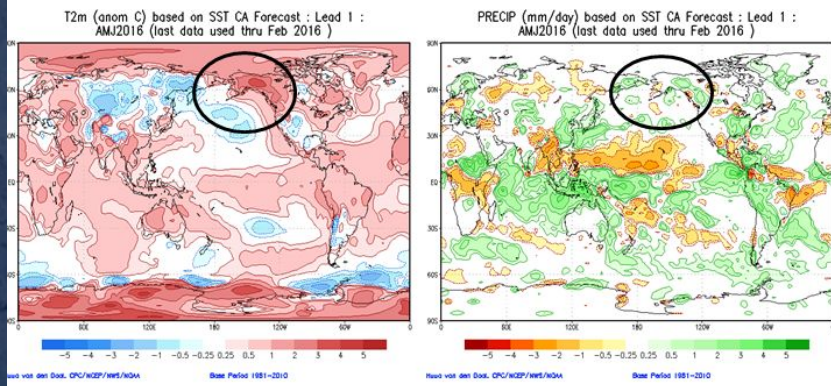


Let's get into the stats...Monthly

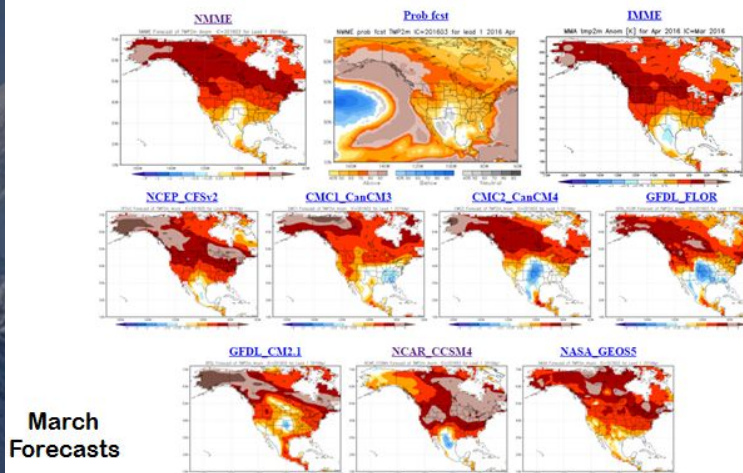
Niño 4 vs. 925mb temp **lagged** correlation
Apr-May (since 1977)



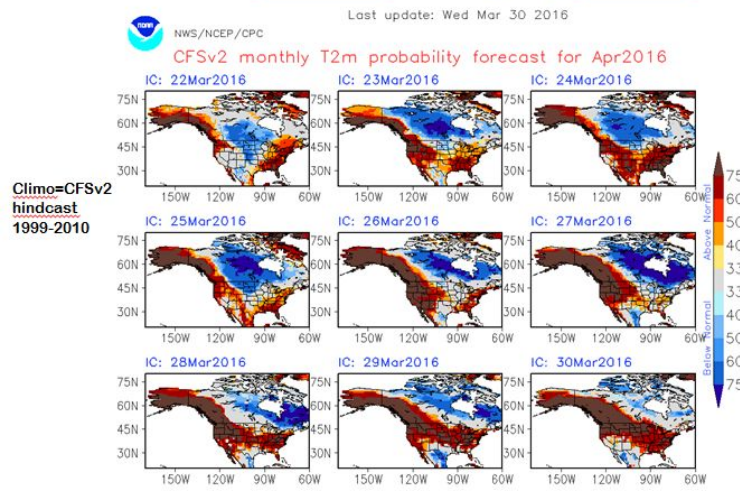
Constructed Analogs based on Global SSTs



April 2016 Temp Anomaly Outlooks



Recent CFS: Tercile Category Probs

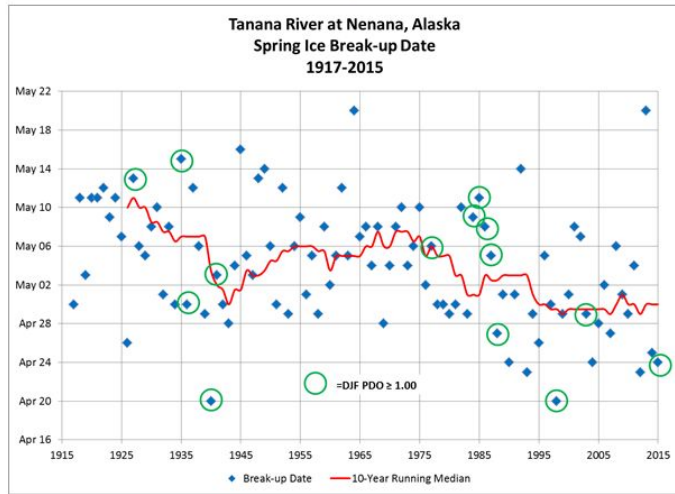




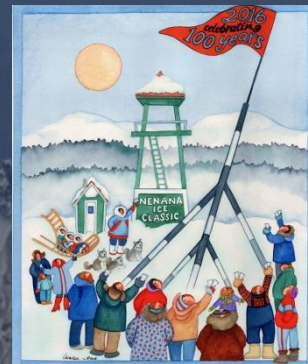
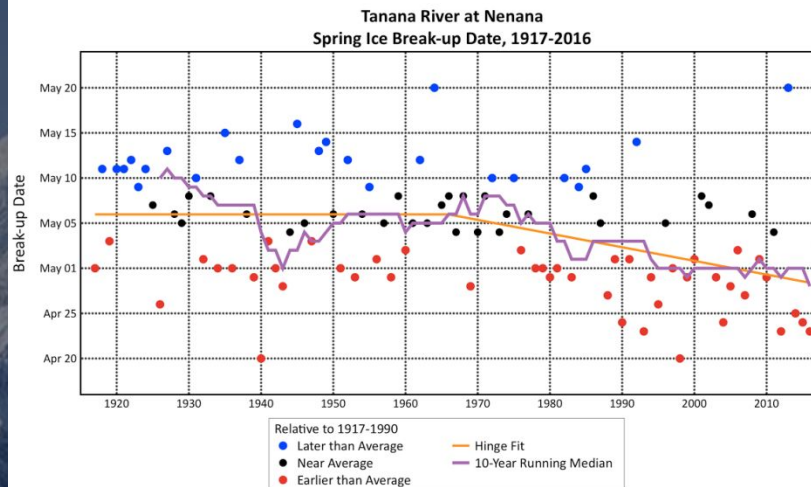
Before We Launch...Lean on Climate

Custom products...briefings upon request

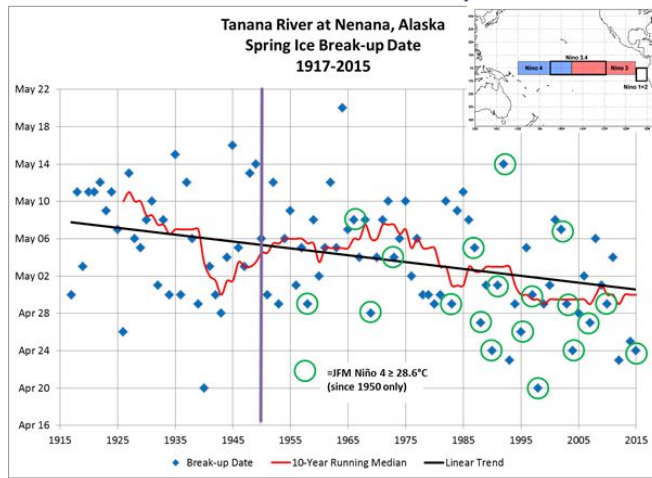
PDO and Break-up Dates



Tanana River at Nenana break-up Dates



Niño 4 SSTs and Break-up



Summary

- Current conditions and dynamic models support significantly increased chances for warm April and May
- No reason to expect precipitation this spring to be a factor (climo chances of wet/snowy late April/May)
- Statistical tools for break-up (early vs. late) tilt toward early



The Outlook...tons of climate

Take the message on the road

...SPRING BREAKUP OUTLOOK FOR ALASKA...

THE SPRING BREAKUP FLOOD POTENTIAL IS CURRENTLY RATED AS **LOW TO LOW-MODERATE** STATEWIDE WITH THE EXCEPTION BEING THE SAG RIVER ON THE NORTH SLOPE WHICH IS MODERATE TO HIGH. THIS FORECAST IS BASED ON OBSERVED SNOWPACK AND ICE THICKNESS REPORTS AND MEDIUM TO LONG RANGE TEMPERATURE AND PRECIPITATION FORECASTS. CURRENTLY BREAKUP AT MOST LOCATIONS IS EXPECTED TO BE A FEW DAYS EARLIER THAN NORMAL.

TEMPERATURES - OVER THE NEXT FEW WEEKS TEMPERATURES ARE LIKELY TO BE NEAR OR ABOVE NORMAL OVER THE MAINLAND. **AVERAGE TEMPERATURES ARE EXPECTED TO BE ABOVE NORMAL STATEWIDE FOR BOTH APRIL AND THE APRIL-MAY-JUNE PERIOD.**

PRECIPITATION - IS NOT EXPECTED TO BE A SIGNIFICANT FACTOR IN THIS YEAR'S BREAKUP PROCESS. THERE IS A SLIGHTLY **INCREASED PROBABILITY FOR ABOVE AVERAGE** PRECIPITATION OVER THE CENTRAL AND WESTERN MAINLAND FOR BOTH THE APRIL AND FOR THE APRIL-MAY-JUNE PERIOD...WITH THE REST OF THE MAINLAND LIKELY TO HAVE NEAR NORMAL PRECIPITATION.

FOR MORE INFORMATION ON THE OUTLOOKS PLEASE REFER TO THE CLIMATE PREDICTION CENTER WEB SITE AT [HTTP://WWW.CPC.NCEP.NOAA.GOV/](http://www.cpc.ncep.noaa.gov/)

ICE - APRIL ICE THICKNESS DATA ARE AVAILABLE FOR A LIMITED NUMBER OF OBSERVING SITES IN ALASKA. APRIL 1ST MEASUREMENTS INDICATE THAT ICE THICKNESS IS VARIABLE ACROSS THE STATE... WITH LOCATIONS GENERALLY BELOW NORMAL WITH A COUPLE OF EXCEPTIONS. MANY LOCATIONS IN THE TANANA BASIN REPORTED BELOW NORMAL THICKNESS. THE FEW ICE MEASUREMENTS ACROSS THE STATE INDICATE ICE THICKNESS IN THE MIDDLE YUKON BASIN AND NORTH SLOPE REGIONS ARE SLIGHTLY BELOW NORMAL TO ABOVE NORMAL... WHILE THICKNESS THROUGHOUT THE REST OF STATE INDICATE BELOW NORMAL CONDITIONS.

SNOW - THE APRIL 1 SNOWPACK ANALYSIS SHOWS BELOW AVERAGE CONDITIONS IN WESTERN AND NORTHERN ALASKA... NEAR NORMAL IN INTERIOR ALASKA... BELOW NORMAL IN SOUTHCENTRAL AND WESTERN ALASKA... AND NEAR NORMAL IN THE UPPER KUSKOKWIM BASIN. SNOW MONITORING SITES IN THE CANADIAN YUKON ARE REPORTING BELOW NORMAL CONDITIONS IN THE CANADIAN YUKON BASIN AND NORMAL SNOWPACK CONDITIONS IN THE PORCUPINE BASIN.

RIVER - REACH	SNOWMELT RUNOFF VOLUME	FLOOD POTENTIAL	AVERAGE BREAKUP DATE *	NO. OF YEARS USED	FORECAST BREAKUP DATE

SOUTHEAST PANHANDLE					
KENAI RIVER					
ANCHOR RIVER	AVERAGE	NONE	04/14	11	3/18**
MATANUSKA RIVER	AVERAGE		04/30	8	04/12-04/18
SUSITNA RIVER		LOW			
GOLD CREEK		LOW	05/03	8	04/21-04/27
SUNSHINE		LOW	05/03	27	04/17-04/23
YENTNA RIVER					
LAKE CREEK	AVERAGE				
		LOW	05/01	25	04/12-04/18
SKWENTNA RIVER					
SKWENTNA	AVERAGE				
		LOW	05/01	21	04/13-04/19
COPPER RIVER BASIN					
GAKONA RVR @ HWY	BELOW				
		LOW	05/02	29	04/21-04/27
GULKANA RVR @ HWY		LOW	05/01	28	04/21-04/27
CHENA RIVER					
CHENA LAKES PROJECT	AVERAGE				
FAIRBANKS		LOW	04/26	24	04/19-04/25
TANANA RIVER					
CHISANA @ NORTHWAY	BELOW				
		LOW	04/26	26	04/20-04/26
SALCHA		LOW			
FAIRBANKS		LOW	05/01	17	04/24-04/30
NENANA		LOW	05/02	36	04/25-05/01



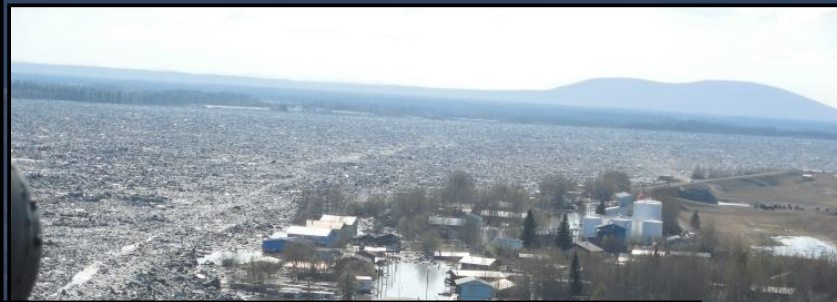
River Watch Program

- At the root, it's Impact-Based Decision Support Services (IDSS) to core partners
- Spin-up begins in April with “preparedness” briefings with community members and DHS&EM
- In full operational mode, crews from APRFC and DHS&EM are launched in small planes to monitor breakup conditions
- Aerial reconnaissance gives hydrologist enhanced ability to assess ice conditions from small aircraft.
- Often you find yourself in real “boots on the ground” situations meeting with community leaders and village elders



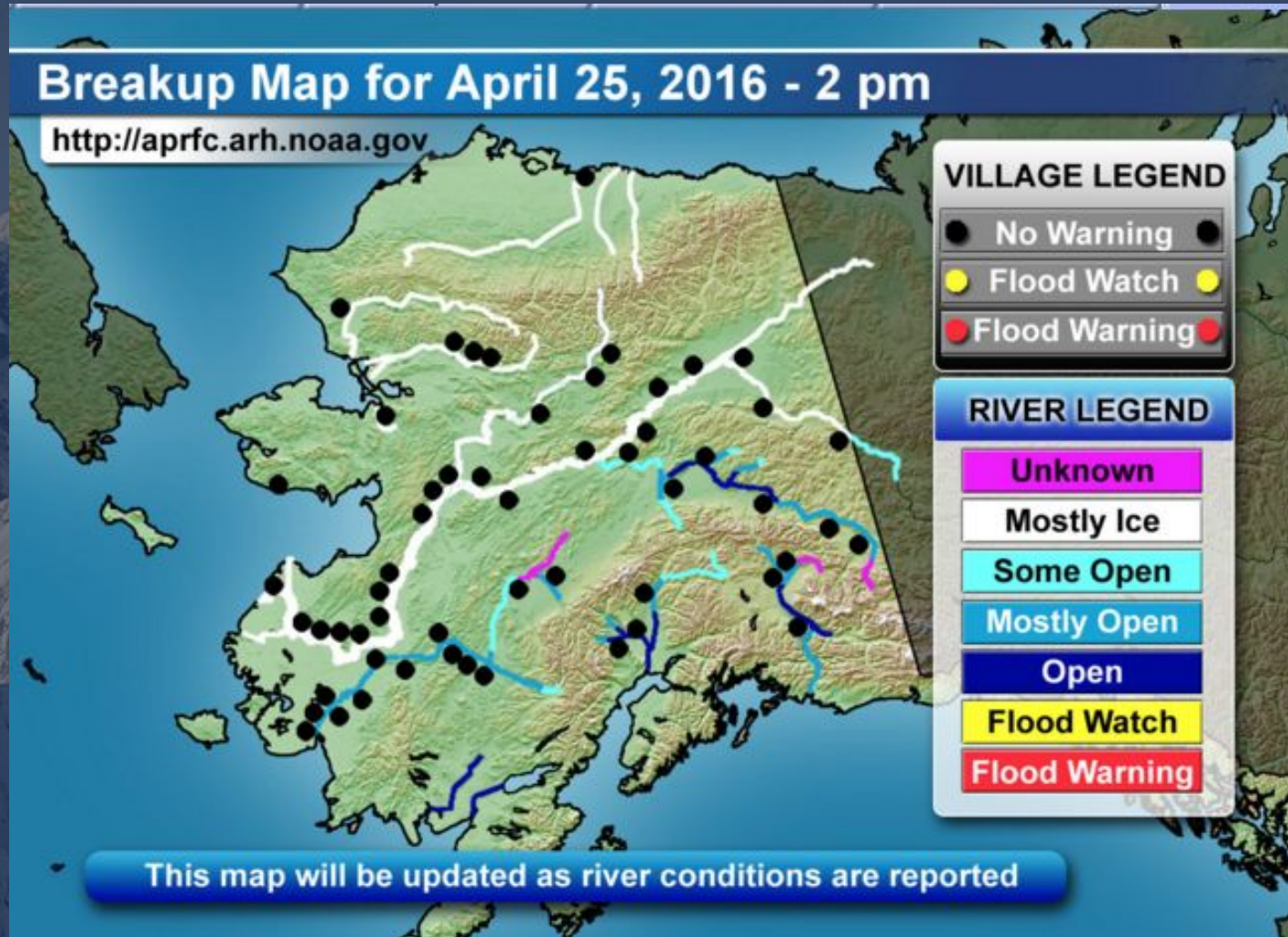
River Watch Deployed

River Watch





River Watch Program

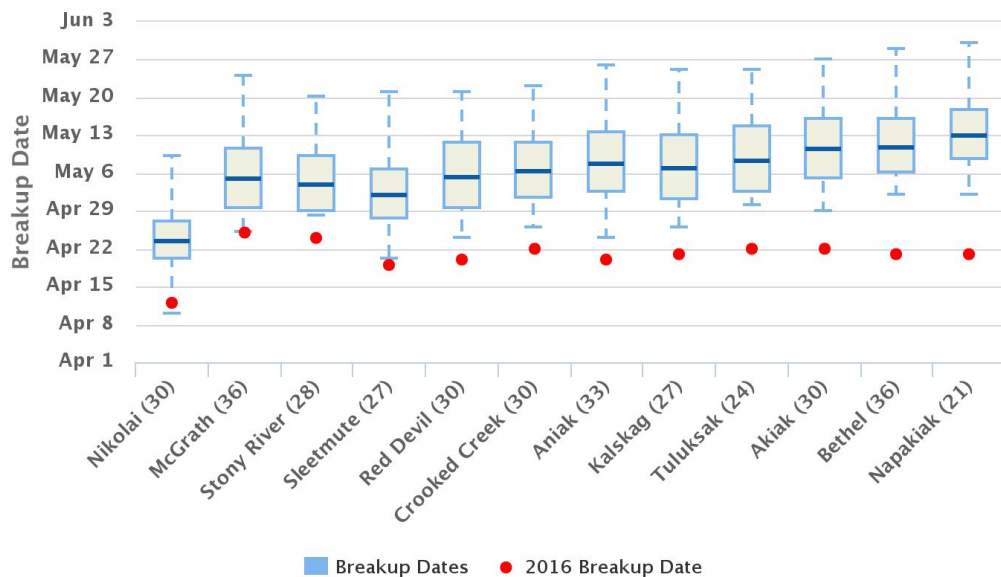




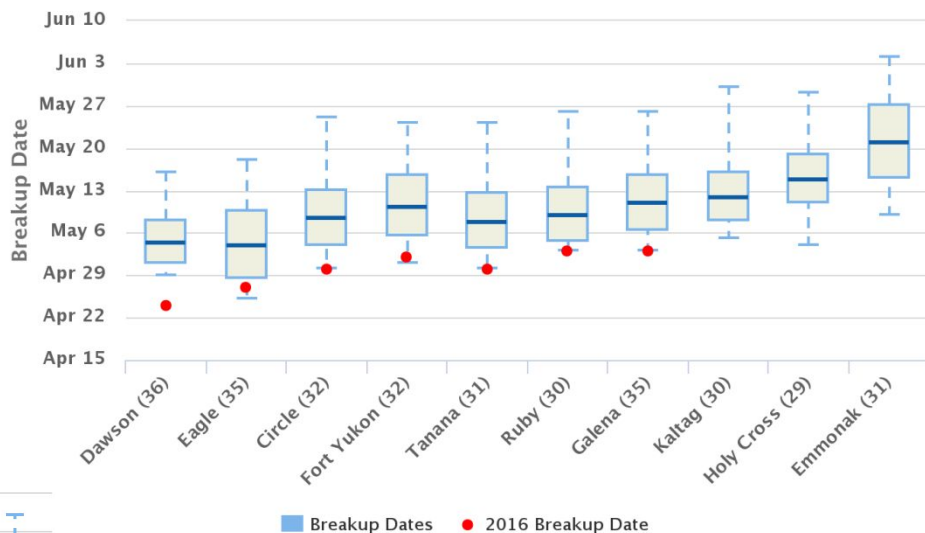
How did it work out???



Kuskokwim River Breakup Dates 1980 - 2015



Yukon River Breakup Dates 1980 - 2015



Nenana went out on April 23(04/20/98)



What were the outcomes????

- The partnership between the state of Alaska and APRFC continues to grow stronger
- The longer range forecasts provided by the Climate Services Manager improves our ability to provide IDSS to villages communities
- This work lines up well with the Weather Ready Nation Roadmap 2.0



Questions???

Alaska spring river ice break up and climate services.

Abstract - During the last couple of years, the Alaska-Pacific River Forecast Center (APRFC) has been able to utilize the services of the Alaska Region, Climate Science and Services Manager, Richard Thoman. The information provided helps the personal at APRFC improve the spring breakup outlooks and spin up the highly successful River Watch program. The River Watch program is a partnership between the state of Alaska, Division of Homeland Security and Emergency Management, and APRFC. During the annual spring ice jam breakup, staff from these organizations partner to do aerial reconnaissance of river and ice observations to identify impacts to village communities. The longer range forecasts provided by the Climate Services Manager, only improves our ability to provide IDSS to village communities and is an excellent example of how the NWS is applying the team concept to operations work in line with the Weather Ready Nation Roadmap 2.0.

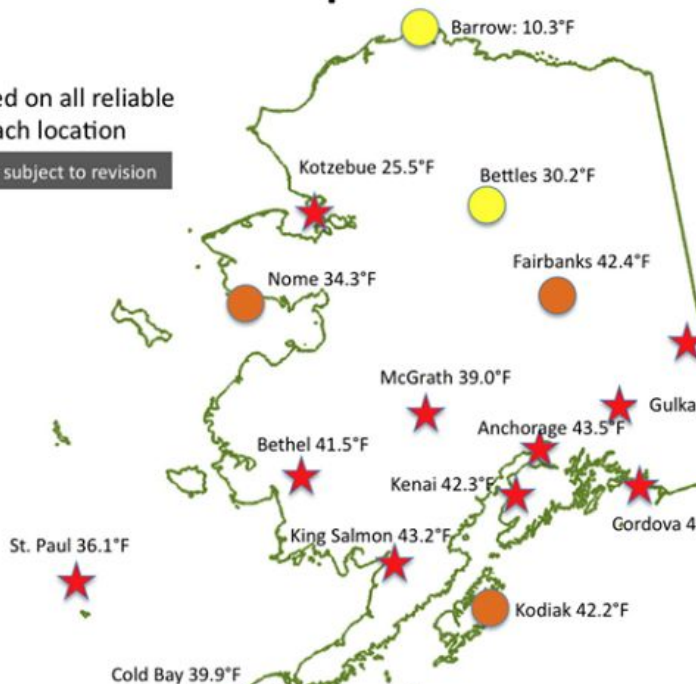
- One of the best examples of Impact-Based Decision Support Services or IDSS in the NWS is the longstanding and highly successful River Watch partnership between the State of Alaska (SOA), Division of Homeland Security and Emergency Management and Alaska-Pacific River Forecast Center (APRFC). During the annual spring ice jam breakup, staff from these organizations partner to do aerial reconnaissance of river observations to identify impacts to village communities. The team meets with local officials and tribal leaders to discuss flood potential and mitigation strategies, which often results in interviews with local and state news outlets. This is an excellent example of how the NWS is applying the team concept to operations work in line with the Weather Ready Nation Roadmap 2.0.



A Warm April Across Alaska

Rankings based on all reliable data at each location

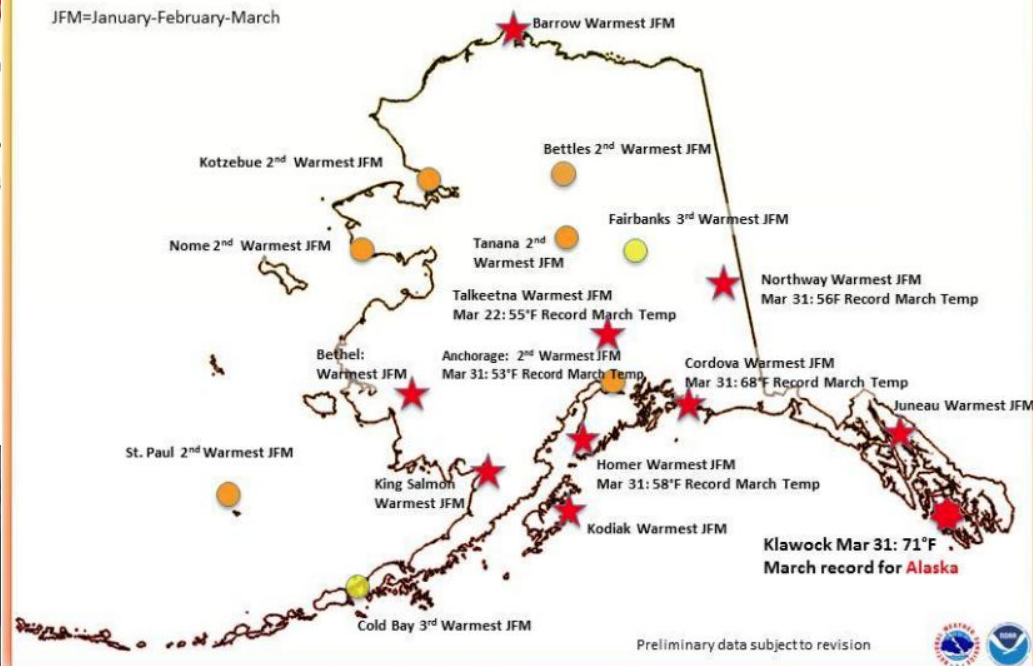
Preliminary data subject to revision



★ Warmest April

Alaska Late Winter Climate Highlights

JFM=January-February-March

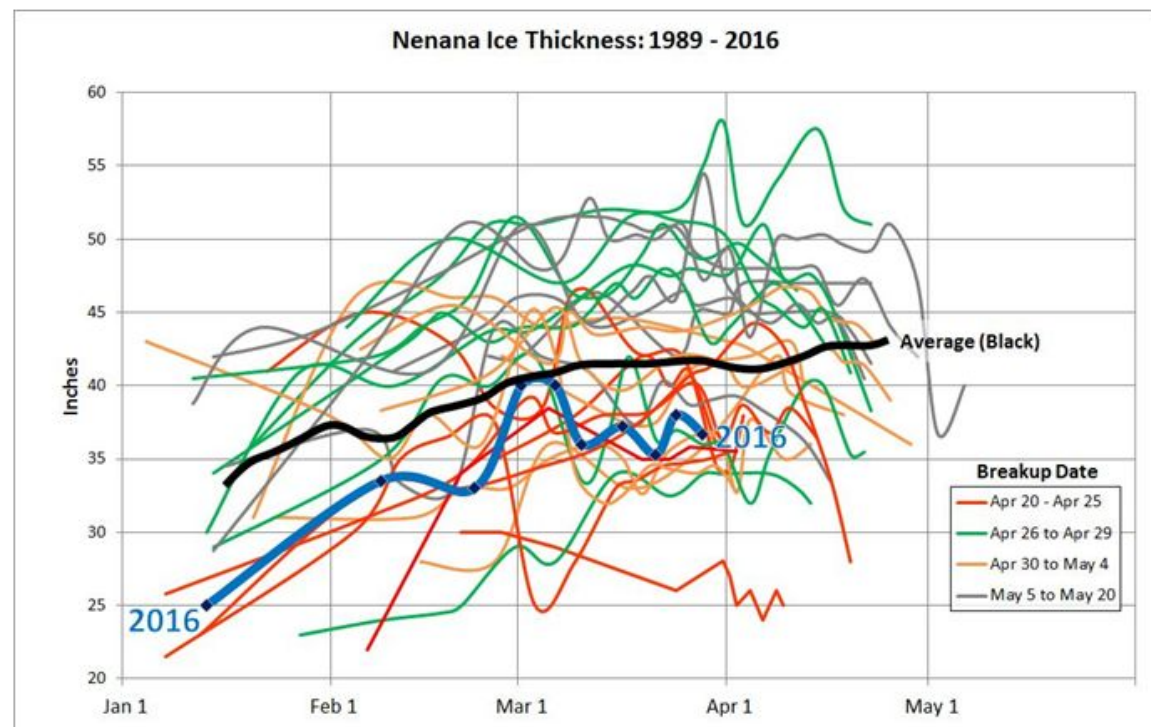


Preliminary data subject to revision





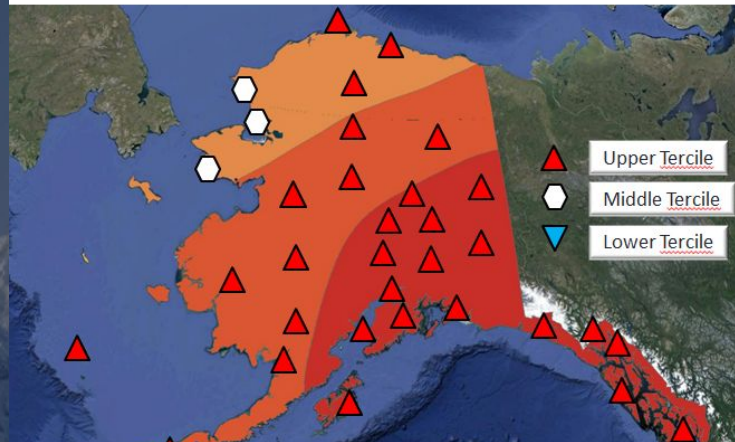
Tanana at Nenana Ice Thickness



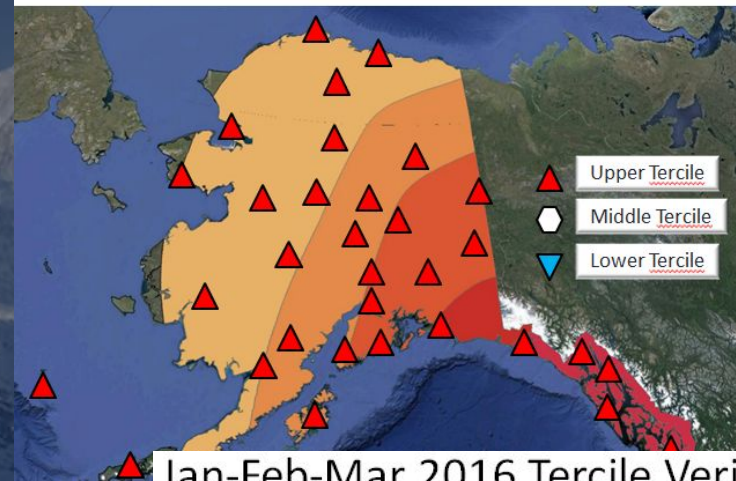


CPC says verification stats pretty darn good...

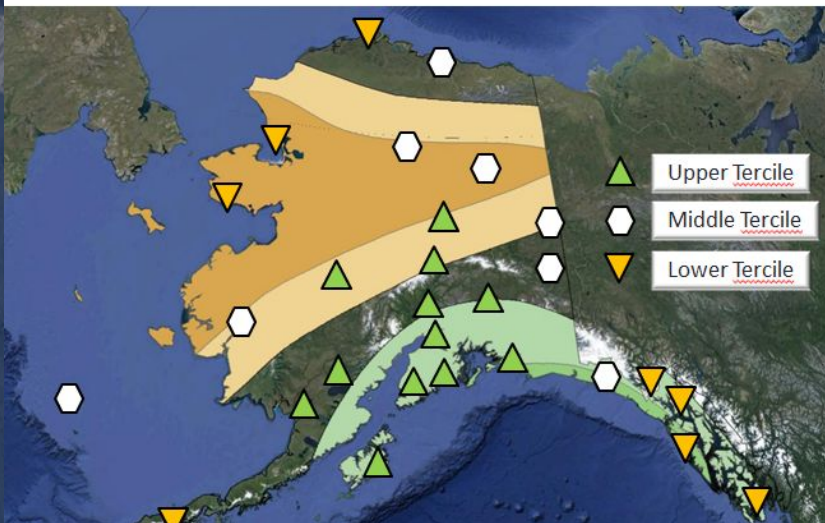
March 2016 Temperature Tercile Verification



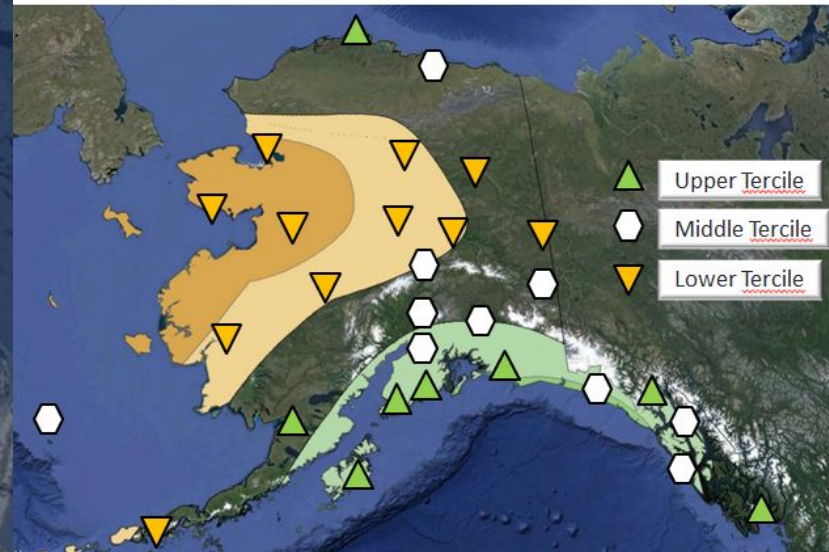
Jan-Feb-Mar 2016 Tercile Verification



March 2016 Temperature Tercile Verification



Jan-Feb-Mar 2016 Tercile Verification





64 Percent of
All Events
Involve Water



Billion Dollar Event Frequency Versus Cumulative Damage Amount 1980-2003

